DOCUMENT RESUME

ED 102 012 SE 018 721

TITLE Pre-Tech Chemistry.
INSTITUTION Florida Junior Coll., Jacksonville.
PUB DATE 74
NOTE 98p.

EDRS PRICE MF-$0.76 HC-$4.43 PLUS POSTAGE
DESCRIPTORS Behavioral Objectives; *Chemistry; *Curriculum Guides; Guides; *Instruction; *Instructional Materials; Science Education; *Secondary School Science; Teaching Guides; Units of Study (Subject Fields)
IDENTIFIERS Florida

ABSTRACT

This course guide is designed to aid chemistry instructors in teaching the skills and knowledge needed by those students planning to take junior college chemistry and is composed of 11 terminal performance objectives, with intermediate performance objectives and sample criterion measures. Suggestions for related laboratory activities are also included. Suggested texts are given. This is considered a student-centered curriculum in chemistry. (Author/ED)

ED102012

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

PRE-TECH CHEMISTRY

SE 018 721

INTRODUCTION

This course guide in Pre-Tech Chemistry is designed to aid the instructor in teaching the skills and knowledges needed by those students planning to take Junior College Chemistry.

It is composed of 11 Terminal Performance Objectives (T.P.O.'s) with Intermediate Performance Objectives (I.P.O.'s) and sample criterion measures. Suggestions for related laboratory activities are also included.

The I.P.O.'s included here represent only the minimum level of competency required of the student for successful performance at the Junior College level. These I.P.O.'s were developed by the writing team in cooperation with the Chemistry department of Florida Junior College. Additional material may be covered at the discretion of the individual instructor.

This guide was developed as a field test model to be piloted during the 1973-1974 school year. There will be an ongoing evaluation during the year and any recommendations by you will be welcomed.

Suggested texts include the 1966 or 1970 editions of Modern Chemistry, Metcalfe, Williams and Castka; Holt Rhinehart and Winston.

CURRICULUM OBJECTIVE

To design, develop, implement, and validate a student-centered curriculum in Chemistry for that student planning on pursuing a post-secondary technical curriculum on the Junior College level. Upon completion of the course, the student will demonstrate his knowledge and understanding; as evidenced by achieving not less than 70% proficiency on the performance test.

PERFORMANCE TEST

The student must score not less than 70% proficiency, as judged by the use of the attached test.

PRE-TECHNICAL CHEMISTRY FINAL EXAM

DIRECTIONS. On the answer sheet, blacken the circle under the letter of the answer which best completes the statement. A Periodic Table of the Elements can be found at the end of this test and may be used throughout.

1. Which of the following is a chemical property?

   a. color
   b. odor
   c. density
   d. combustion

2. All of the following statements correctly describe a compound except:

   a. A compound is made up of atoms.
   b. A compound is made up of molecules.
   c. Every compound has a definite composition by weight.
   d. Elements which combine to form a compound retain their original properties.

3. Which of the following statements best describes a mole?

   a. A mole is the atomic number of an element expressed in grams.
   b. A mole is the isotope number of an element expressed in grams.
   c. A mole is the atomic weight of an element expressed in grams.
   d. A mole is the Avogadro number expressed in grams.

4. The number of moles of phosphorus in 62 grams of the element is:

   a. 1
   b. 2
   c. 3
   d. 4

5. The number of moles in 66 grams of CO_2 is:

   a. 1
   b. 1.5
   c. 2
   d. 3.3

6. The atomic number of an atom may be defined as:

   a. the sum of the protons and neutrons in the nucleus
   b. the protons in the nucleus of an atom
   c. the difference between the protons and neutrons
   d. the number of electrons in an ion

7. The statement which best describes the Bohr concept of the atom is:

   a. Electrons constantly gain and lose energy as they move in their energy levels.
   b. When an electron moves from a ground state to an excited state, it loses energy.
   c. Electrons emit electricity when they return to their ground state.
   d. As electrons move in their energy levels, no energy loss occurs.

8. The secondary quantum number of an electron represents:

   a. the relative average distance of the electron from the nucleus
   b. the spatial orientation of the orbital
   c. the shape of the orbital
   d. direction the electron rotates on its axis

9. The maximum number of electrons which can be in the third energy level is:

   a. 50
   b. 32
   c. 18
   d. 8

10. The correct orbital notation for the third energy level of aluminum is:

    a. $3s^1 3p^2$

    b. $3s^3$

    c. $3s^2 3p^1$

    d. $3s^2 3d^1$

11. Sulfur is located in group VI of the Periodic Table and has a total of 16 electrons. How many electrons are in its outer energy level?

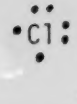
    a. 8
    b. 6
    c. 4
    d. 3

12. The correct electron dot notation for the chlorine atom is:

    a.

    b.

    c.

    d. 

13. An atom is chemically stable when its outermost energy level is occupied by:

    a. an octet of electrons
    b. a pair of electrons
    c. 18 electrons
    d. 32 electrons

14. An ionic bond is formed when:

    a. electrons are shared by atoms
    b. electrons are transferred from one atom to another
    c. electrons are unequally shared by atoms
    d. an atom shares more than one electron with another atom

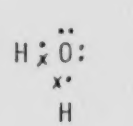
15. A covalent bond is formed by electron:

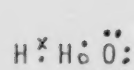
    a. sharing
    b. gaining
    c. losing
    d. splitting

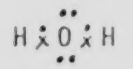
16. Molecules are particles formed by:

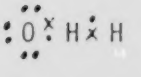
    a. ionic bonding
    b. isotopic bonding
    c. anions
    d. covalent bonding

17. The correct electron dot structure for water is:

    a. 

    b. 

    c. 

    d. 

18. A pure covalent bond:

    a. is a bond in which there is an unequal attraction for the shared electrons
    b. a bond in which there is an equal attraction for the shared electrons
    c. a bond formed when one atom contributes more than one electron to the bond
    d. is formed between group I metals and group VI nonmetals

19. The carbon tetrachloride molecule is:

a. polar
b. ionic
c. nonpolar
d. isotopic

20. Of the following statements, which best describes polar molecules:

a. Attractive forces between polar molecules are weaker than Van der Waals forces.
b. At room conditions they exist as gases.
c. There is no separation of the centers of positive and negative charges.
d. The shared electron pair is arranged unsymmetrically between the bonded atoms.

21. Of the following elements, which would have the lowest electronegativity?

a. metals
b. nonmetals
c. transition elements
d. the Halogens

22. Which of the following statements concerning ionization energy is true?

a. The ionization energy of the Noble Gases is extremely low.
b. The ionization energy of metals is low.
c. The ionization energy of nonmetals does not vary uniformly from element to element.
d. The ionization energy of the diatomic gas molecules is low.

23. As the atomic number of the elements in a group increases, the atomic radius of the successive elements:

a. decreases only
b. increases then decreases
c. increases only
d. remains the same

24. In the compound, $CaCl_2$, the correct oxidation number for calcium is +2, therefore the correct oxidation number for chloride in this compound is:

a. 0
b. +1
c. -2
d. -1

25. The correct formula for the compound, potassium oxide, is:

a. KO
b. K_2O
c. KO_2
d. K_2O_2

26. The correct formula for ferric nitrate is:

a. $Fe(NO_3)_3$
b. $FeNO_3$
c. Fe_3NO_3
d. $Fe(NO_3)_2$

27. The correct name for the compound, P_2O_5, is:

a. diphosphate
b. phosphorus oxide
c. biphosphorus tetroxide
d. diphosphorus pentoxide

28. The correct name for the acid which has the formula, HNO_3, is:

a. hydronitric acid
b. nitric acid
c. nitrous acid
d. nitrogenous acid

29. The correct name of the compound which has the formula, $BaCl_2 \cdot 2H_2O$, is:

a. barium chloride dihydrate
b. barium chloride bihydrate
c. barium chloride pentahydrate
d. barium chloride anhydride

30. When the equation, $Al_2(SO_4)_3 + Mg(OH)_2 \longrightarrow Al(OH)_3 + MgSO_4$, is correctly balanced the coefficient in front of the $Mg(OH)_2$ is:

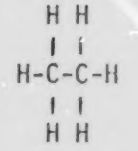
a. 1
b. 2
c. 3
d. 4

31. The chemistry dealing with the study of compounds containing carbon is:

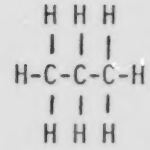
a. physical chemistry
b. organic chemistry
c. inorganic chemistry
d. analytical chemistry

32. Of the following, the one that is the structural formula for propane is:

a. C_2H_6

b.


c. C_3H_8

d.


33. All of the following statements describe the volume of a gas except:

a. Gas volume is dependent on pressure.
b. Gas volume decreases as the barometer reading increases.
c. Gas volume varies directly with the Kelvin temperature.
d. The volume of a gas varies inversely with its rate of diffusion.

34. According to the kinetic theory, which of the following characteristics best describes gas molecules:

a. having strong attractive forces between molecules
b. occupying a definite volume
c. being close together
d. moving rapidly in a random fashion

35. The correct algebraic expression for the Ideal Gas Law is:

a. PV = nRT
b. PT = nVR
c. PR = VTn
d. TV = nRP

36. The molar volume of a gas at standard conditions of temperature and pressure is:

a. 6.02×10^{23} liters
b. 67.2 liters
c. 22.4 liters
d. 760 liters

37. Which of the following is a property of a gas?

a. definite volume
b. definite shape
c. evaporation
d. pressure

38. The Kelvin temperature which is equivalent to 30° C. is:

a. 303° K
b. 240° K
c. 730° K
d. 790° K

39. Van der Waals forces become significant when gas molecules exhibit all of the following except:

a. high pressure
b. low density
c. temperatures near their condensation point
d. at the critical temperature and pressure

40. When the hydrogen end of one water molecule bonds to the oxygen end of an adjacent water molecule, what type of bond is formed?

a. hydrogen
b. covalent
c. oxygen
d. coordinate covalent

41. Evaporation occurs because:

a. some molecules in a liquid have less energy than others and are therefore forced to leave the container.
b. some molecules acquire sufficient kinetic energy to escape continually from the surface.
c. the liquid heats up, therefore increasing surface tension.
d. the density of the liquid must decrease due to the increasing energy of the molecules toward the bottom of the container.

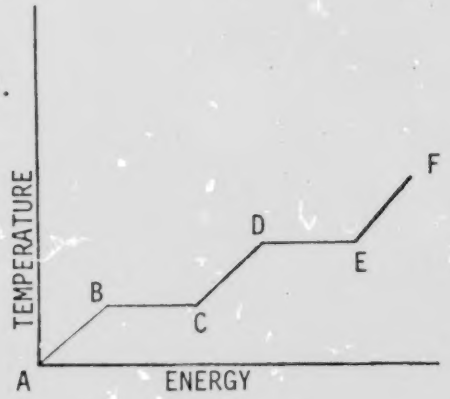
42. The temperature at which the equilibrium vapor pressure is equal to the prevailing atmospheric pressure is the:

a. equilibrium point
b. melting point
c. boiling point
d. freezing point

43. Which of the following is not true of the freezing process?

a. The particles become arranged in definite patterns which have fixed positions in space.
b. The attractive forces between particles increase.
c. The kinetic energy of the particles decrease.
d. The motion of the particles become more rapid and random.

44.



The graph above represents the changes of state of water. The freezing point on the graph is at point:

a. A
b. B
c. E
d. F

45. The dissolved substance in a solution is the:

a. solvent
b. solute
c. precipitate
d. suspended phase

46. The molarity of a solution is defined as:

a. the number of moles of solute per kilogram of solvent
b. the number of grams of solute per mole of solvent
c. the number of moles of solute per liter of solution
d. the number of moles of solute per liter of solvent

47. All of the following describe the interaction between water molecules and ions dissolved in water, <u>except</u>:

a. The positive ions are attracted to the oxygen end of the water molecules.
b. The negative ions are attracted to the hydrogen end of the water molecules.
c. The polarity of the water dipoles enable them to attract positively and negatively charged ions.
d. Hydrogen bonds form between water molecules and the ions.

48. The equation which represents a solution in a state of dynamic equilibrium is:

a. $Na^+Cl^- \longrightarrow Na^+ + Cl^-$

b. $Na^+ + Cl^- \longrightarrow NaCl$

c. $Na^+Cl^-(s) \rightleftharpoons Na^+(aq) + Cl^-(aq)$

d. $NaCl \rightleftharpoons Na(aq) + Cl(aq)$

49. All of the following describe a saturated solution of sodium chloride in water, except:

a. The solution contains a maximum amount of solute in a given amount of solvent.
b. The solution is in a state of physical equilibrium.
c. The processes of dissociation and recrystallization are occurring at equal rates.
d. The amount of the solute in solution depends upon the pressure applied.

50. The correct formula for one of the ions formed when KNO_3 dissociates in water is:

a. $K^-(aq)$
b. $NO_3^- \cdot 2H_2O$
c. $K^+(aq)$
d. $NO_3^+(aq)$

51. According to the Bronsted-Lowry Theory of acids and bases, acids may be defined as a species that:

a. loses a proton in a chemical reaction
b. loses an electron in a chemical reaction
c. gains a proton in a chemical reaction
d. gains an electron in a chemical reaction

52. Of the following statements about acids, the one which is true is:

a. Acids which ionize completely in water solution are weak acids.
b. Solutions of strong acids are mostly molecular.
c. Solutions of strong acids are strong electrolytes.
d. Strong acids furnish very few ions in solution.

53. The common industrial (strong) acids are:

a. acetic, nitric, sulfuric
b. nitric, sulfuric, hydrochloric
c. phosphoric, ammonium, acetic
d. sulfuric, hydrofluoric, cyanic

54. The correct formulas which represent a solution of hydrochloric acid are:

a. H^+ and Cl^-
b. H_3O^+ and Cl_2^-
c. $H_3O^+(aq)$ and $Cl^-(aq)$
d. $H_2^+(aq)$ and $Cl_2^-(aq)$

55. Of the following, which is the correctly balanced net ionic equation for the reaction between KOH and H_2SO_4?

a. $OH^-(aq) + H_3O^+(aq) \longrightarrow 2H_2O$

b. $2KOH + H_2SO_4 \longrightarrow K_2SO_4 + 2H_2O$

c. $2K^+(aq) + 2OH^- + 2H_3O^+ + SO_4^{=} \longrightarrow 2K^+ + SO_4^{=} + 4H_2O$

d. $2K^+ + SO_4^{=} \longrightarrow K_2SO_4$

56. Any chemical reaction which involves the loss of one or more electrons by an atom or ion is:

a. reduction
b. hybridization
c. catalysis
d. oxidation

57. The process of measuring quantitatively the capacity of a solution of unknown concentration to combine with one of known concentration, is known as:

a. titration
b. qualitative analysis
c. quantitative synthesis
d. fractional distillation

58. The pH range of an acid solution is:

a. 7 - 14
b. 0 to 6
c. 0 to 14
d. 8 - 14

59. The normality of a 2.0 M. solution of sulfuric acid is:

a. 4.0 N
b. 2.0 N
c. 1.0 N
d. 6.0 N

60. The presence of an excess of hydroxide ions results in a/an:

a. acid solution
b. anhydride solution
c. basic solution
d. salt solution

PROBLEM SECTION. Questions 61-80 are problems and count two points each. Scratch paper will be provided by the instructor. Use of logarithm charts or a slide rule is permitted.

61. A rectangular slab measuring 5.0 cm. long, .02 meters high, and .15 dm. high has a mass of 30 grams. What is its density?

a. 2.0 g/cm^3
c. 30 g/cm^3
b. 15 g/cm^3
d. 450 g/cm^3

62. The correct percent of mercury in Hg_2O is:

a. 3.8%
b. 48.1 %
c. 92.6 %
d. 96.2 %

63. A compound contains: nitrogen, 30.51%; oxygen, 69.49%. Its gram molecular weight is 46 grams. What is its molecular formula?

a. NO
c. N_2O
b. NO_2
d. N_2O_4

64. How many moles of hydrogen gas are contained in a 2.50 liter flask at 20° C. and 700 mm. pressure?

a. .096 moles
b. .110 moles
c. .113 moles
d. .130 moles

65. A gas has a volume of 240.0 ml. at 70.0 cm. pressure. What pressure, in millimeters of mercury, is needed to reduce the volume to 60.0 ml?

a. 17.5 mm.
b. 175 mm.
c. 280 mm.
d. 2800 mm.

66. Convert to standard conditions: 100 ml. of a gas at -23° C. and 700 mm. pressure.

a. 1186 ml.
b. 1006 ml.
c. 994 ml.
d. 843 ml.

67. A gas-measuring tube contains 40.0 ml. of air collected over water at a temperature of 20.0° C. The water level inside the eudiometer is 27.2 mm. higher than that outside. The barometer reads 740.0 mm. What is the volume of the gas at S.T.P? The water vapor pressure at 20.0° C. is 17.5 mm.

a. 351 ml.
b. 396 ml.
c. 404 ml.
d. 455 ml.

68. The mass of 1.00 liter of a gas at S.T.P. is 2.75 grams. What is the mass of one mole of the gas?

a. 8.1 grams
b. 19.7 grams
c. 61.6 grams
d. 25.2 grams

69. The number of moles of aluminum atoms reacting with 1.5 moles of sulfuric acid in the equation $2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2\uparrow$ is:

a. 1
b. 1.5
c. 2
d. 3

70. In the equation $2NaClO_3 \longrightarrow 2NaCl + 3O_2\uparrow$, the number of grams of $NaClO_3$ required to produce 1.0 mole of oxygen gas is:

a. 107 grams
b. 142 grams
c. 213 grams
d. 320 grams

71. The number of grams of oxygen gas reacting with 216 grams of aluminum to form aluminum oxide is:

a. 16 grams
b. 32 grams
c. 96 grams
d. 192 grams

72. How many liters of carbon dioxide, at standard temperature and pressure, would be produced on decomposition of 200 grams of calcium carbonate? (Calcium oxide is the other product).

a. 22.4 liters
b. 44.8 liters
c. 67.2 liters
d. 112.0 liters

73. Carbon monoxide burns in oxygen to form carbon dioxide. How many liters of carbon dioxide are produced when 30.0 liters of carbon monoxide burns?

a. 2 liters
b. 15 liters
c. 22.4 liters
d. 30 liters

74. A student is performing an experiment entitled, Mass Relations in a Chemical Change. In the experiment, 2.00 grams of copper was placed in a crucible with excess sulfur and heated to constant mass. The mass of the resulting product of copper II sulfide was found to be 2.75 grams. After computing the theoretical yield as 2.69 grams, what value would the student give as his percentage of error?

a. 0.60 %
b. 6.00 %
c. 2.13 %
d. 21.0 %

75. Calculate the molarity of a 500 ml. solution that contains 10.0 grams of silver nitrate.

a. 0.5 M
b. 1.0 M
c. 1.5 M
d. 2.0 M

76. How many moles of mercury II oxide will there be in 200 ml. of 0.50 M. solution?

a. 400.0 moles
b. 10.0 moles
c. 0.50 moles
d. 0.10 moles

77. How many grams of sodium hydroxide are needed to make 250 ml. of a one molar solution?

a. 160 grams
b. 40 grams
c. 10 grams
d. 4 grams

78. Calculate the molality of a solution made by dissolving 45.0 grams of dextrose ($C_6H_{12}O_6$) in 500.0 grams of water.

a. 5.0 m
b. 0.5 m
c. 0.1 m
d. 0.25 m

79. The equivalent weight of zinc chloride is:

a. 34 grams
b. 48 grams
c. 68 grams
d. 136 grams

80. How many moles of oxygen will be needed to react with .75 moles of magnesium to produce magnesium oxide?

a. .375
b. .50
c. 1
d. 2

PERIODIC CLASSIFICATION OF THE ELEMENTS*

BEST COPY AVAILABLE

I	II											III	IV	V	VI	VII	VIII
1 H 1.008																1 H 1.008	2 He 4.003
3 Li 6.94	4 Be 9.013											5 B 10.82	6 C 12.011	7 N 14.008	8 O 16.0000	9 F 19.00	10 Ne 20.183
11 Na 22.991	12 Mg 24.32											13 Al 26.98	14 Si 28.09	15 P 30.975	16 S 32.066	17 Cl 35.457	18 Ar 39.944
19 K 39.100	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.95	24 Cr 52.01	25 Mn 54.94	26 Fe 55.85	27 Co 58.94	28 Ni 58.71	29 Cu 63.54	30 Zn 65.38	31 Ga 69.72	32 Ge 72.60	33 As 74.91	34 Se 78.96	35 Br 79.16	36 Kr 83.81
37 Rb 85.48	38 Sr 87.63	39 Y 88.92	40 Zr 91.22	41 Nb 92.91	42 Mo 95.95	43 Tc (99)	44 Ru 101.7	45 Rh 102.91	46 Pd 106.4	47 Ag 107.880	48 Cd 112.41	49 In 114.82	50 Sn 118.70	51 Sb 121.76	52 Te 127.61	53 I 126.91	54 Xe 131.30
55 Cs 132.91	56 Ba 137.36	57 TO 71 (see below)	72 Hf 178.50	73 Ta 180.95	74 W 183.86	75 Re 186.22	76 Os 190.2	77 Ir 192.2	78 Pt 195.09	79 Au 197.0	80 Hg 200.61	81 Tl 204.39	82 Pb 207.21	83 Bi 209.00	84 Po (210)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.05	89 TO 103 (see below)															

* Numbers in parentheses refer to radioactive elements; mass number (not the atomic weight) of the isotope with the largest half-life is given.

Lanthanide series	57 La 138.92	58 Ce 140.13	59 Pr 140.92	60 Nd 144.27	61 Pm (145)	62 Sm 150.35	63 Eu 152.0	64 Gd 157.26	65 Tb 158.93	66 Dy 162.51	67 Ho 164.94	68 Er 167.27	69 Tm 168.94	70 Yb 173.04	71 Lu 174.99		
Actinide series	89 Ac (227)	90 Th 232.05	91 Pa (231)	92 U 238.07	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (254)	103 Lw (257)		

* (BASED ON $C^{12} = 12.0000$)

ANSWER KEY

BEST COPY AVAILABLE

Pre-Tech Chemistry

STUDENT'S NAME_____

TEACHER_____

SCHOOL_____

ANSWER KEY: Please SHADE in the answer which you wish to indicate.

	a	b	c	d
1.	( )	( )	( )	( )
2.	( )	( )	( )	( )
3.	( )	( )	( )	( )
4.	( )	( )	( )	( )
5.	( )	( )	( )	( )
6.	( )	( )	( )	( )
7.	( )	( )	( )	( )
8.	( )	( )	( )	( )
9.	( )	( )	( )	( )
10.	( )	( )	( )	( )
11.	( )	( )	( )	( )
12.	( )	( )	( )	( )
13.	( )	( )	( )	( )
14.	( )	( )	( )	( )
15.	( )	( )	( )	( )
16.	( )	( )	( )	( )
17.	( )	( )	( )	( )
18.	( )	( )	( )	( )
19.	( )	( )	( )	( )
20.	( )	( )	( )	( )
21.	( )	( )	( )	( )
22.	( )	( )	( )	( )
23.	( )	( )	( )	( )
24.	( )	( )	( )	( )
25.	( )	( )	( )	( )
26.	( )	( )	( )	( )
27.	( )	( )	( )	( )
28.	( )	( )	( )	( )
29.	( )	( )	( )	( )
30.	( )	( )	( )	( )
31.	( )	( )	( )	( )
32.	( )	( )	( )	( )
33.	( )	( )	( )	( )
34.	( )	( )	( )	( )
35.	( )	( )	( )	( )
36.	( )	( )	( )	( )
37.	( )	( )	( )	( )
38.	( )	( )	( )	( )
39.	( )	( )	( )	( )
40.	( )	( )	( )	( )
41.	( )	( )	( )	( )
42.	( )	( )	( )	( )
43.	( )	( )	( )	( )
44.	( )	( )	( )	( )
45.	( )	( )	( )	( )
46.	( )	( )	( )	( )
47.	( )	( )	( )	( )
48.	( )	( )	( )	( )
49.	( )	( )	( )	( )
50.	( )	( )	( )	( )
51.	( )	( )	( )	( )
52.	( )	( )	( )	( )
53.	( )	( )	( )	( )
54.	( )	( )	( )	( )
55.	( )	( )	( )	( )
56.	( )	( )	( )	( )
57.	( )	( )	( )	( )
58.	( )	( )	( )	( )
59.	( )	( )	( )	( )
60.	( )	( )	( )	( )
61.	( )	( )	( )	( )
62.	( )	( )	( )	( )
63.	( )	( )	( )	( )
64.	( )	( )	( )	( )
65.	( )	( )	( )	( )
66.	( )	( )	( )	( )
67.	( )	( )	( )	( )
68.	( )	( )	( )	( )
69.	( )	( )	( )	( )
70.	( )	( )	( )	( )
71.	( )	( )	( )	( )
72.	( )	( )	( )	( )
73.	( )	( )	( )	( )
74.	( )	( )	( )	( )
75.	( )	( )	( )	( )
76.	( )	( )	( )	( )
77.	( )	( )	( )	( )
78.	( )	( )	( )	( )
79.	( )	( )	( )	( )
80.	( )	( )	( )	( )

STUDENT'S NAME_____ Pre-Tech Chemistry

TEACHER_____

SCHOOL_____

ANSWER KEY: Please SHADE in the answer which you wish to indicate.

	a	b	c	d		a	b	c	d		a	b	c	d		a	b	c	d
1.	( )	( )	( )	( )	21.	( )	( )	( )	( )	41.	( )	( )	( )	( )	61.	( )	( )	( )	( )
2.	( )	( )	( )	( )	22.	( )	( )	( )	( )	42.	( )	( )	( )	( )	62.	( )	( )	( )	( )
3.	( )	( )	( )	( )	23.	( )	( )	( )	( )	43.	( )	( )	( )	( )	63	( )	( )	( )	( )
4.	( )	( )	( )	( )	24.	( )	( )	( )	( )	44.	( )	( )	( )	( )	64.	( )	( )	( )	( )
5.	( )	( )	( )	( )	25.	( )	( )	( )	( )	45.	( )	( )	( )	( )	65.	( )	( )	( )	( )
6.	( )	( )	( )	( )	26.	( )	( )	( )	( )	46.	( )	( )	( )	( )	66.	( )	( )	( )	( )
7.	( )	( )	( )	( )	27.	( )	( )	( )	( )	47.	( )	( )	( )	( )	67.	( )	( )	( )	( )
8.	( )	( )	( )	( )	28.	( )	( )	( )	( )	48.	( )	( )	( )	( )	68.	( )	( )	( )	( )
9.	( )	( )	( )	( )	29.	( )	( )	( )	( )	49.	( )	( )	( )	( )	69.	( )	( )	( )	( )
10	( )	( )	( )	( )	30.	( )	( )	( )	( )	50.	( )	( )	( )	( )	70.	( )	( )	( )	( )
11.	( )	( )	( )	( )	31.	( )	( )	( )	( )	51.	( )	( )	( )	( )	71.	( )	( )	( )	( )
12.	( )	( )	( )	( )	32.	( )	( )	( )	( )	52.	( )	( )	( )	( )	72.	( )	( )	( )	( )
13.	( )	( )	( )	( )	33.	( )	( )	( )	( )	53.	( )	( )	( )	( )	73.	( )	( )	( )	( )
14.	( )	( )	( )	( )	34.	( )	( )	( )	( )	54.	( )	( )	( )	( )	74.	( )	( )	( )	( )
15.	( )	( )	( )	( )	35.	( )	( )	( )	( )	55.	( )	( )	( )	( )	75.	( )	( )	( )	( )
16.	( )	( )	( )	( )	36.	( )	( )	( )	( )	56.	( )	( )	( )	( )	76.	( )	( )	( )	( )
17.	( )	( )	( )	( )	37.	( )	( )	( )	( )	57.	( )	( )	( )	( )	77.	( )	( )	( )	( )
18.	( )	( )	( )	( )	38.	( )	( )	( )	( )	58.	( )	( )	( )	( )	78.	( )	( )	( )	( )
19.	( )	( )	( )	( )	39.	( )	( )	( )	( )	59.	( )	( )	( )	( )	79.	( )	( )	( )	( )
20.	( )	( )	( )	( )	40.	( )	( )	( )	( )	60.	( )	( )	( )	( )	80.	( )	( )	( )	( )

ANSWER KEY
Pre-Tech Chemistry

1. D
2. D
3. C
4. B
5. B
6. B
7. D
8. C
9. C
10. C
11. B
12. A
13. A
14. B
15. A
16. D
17. A
18. B
19. C
20. D
21. A
22. B
23. C
24. D
25. B
26. A
27. D
28. B
29. A
30. C
31. B
32. D
33. D
34. D
35. A
36. C
37. D
38. B
39. B
40. A
41. B
42. C
43. D
44. A
45. B
46. C
47. D
48. C
49. D
50. C
51. A
52. C
53. B
54. C
55. A
56. D
57. A
58. B
59. A
60. C
61. A
62. D
63. D
64. A
65. D
66. B
67. A
68. C
69. A
70. B
71. D
72. B
73. D
74. C
75. A
76. D
77. C
78. B
79. C
80. A

COURSE DESCRIPTION

Pre-Tech Chemistry 10 11 12

Pre-Technical

Prerequisites: Strong background in Algebra I and taking Geometry or Algebra II.

This course is designed to provide the student with the skills and knowledge necessary for the Junior College or technical post-secondary courses. It includes the study of classes of matter, atomic structure, chemical bonding, periodic properties, formula writing, gas laws, chemical stoichiometry, physical states of matter and solutions, including acids and bases. Stoichiometry is limited to simple chemical and mathematical relationships. Mathematical problem solving using pH is not included.

Pre-Tech Chemistry

T.P.O. 1.0
X-5.325
The student will demonstrate his knowledge, understanding and skills of measurement, as it relates to the metric system, conversion, and density relationships with related laboratory techniques using metric apparatus; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 2.0
X-5.312
X-5.316
The student will demonstrate his knowledge, understanding and skills as they relate to chemical elements and compounds; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 3.0
X-5.312
X-5.315
X-5.316
The student will demonstrate his knowledge, understanding and skills as they relate to atomic structure; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 4.0
X-5.318
The student will demonstrate his knowledge, understanding and skills as they relate to chemical bonding; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s.

T.P.O. 5.0
X-5.312
X-5.316
The student will demonstrate his knowledge, understanding and skills as they relate to the periodic properties of the elements with use of the periodic table when applicable; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s.

T.P.O. 6.0
X-5.312
After having memorized a table of common ions and their charges, the student will demonstrate his knowledge, understanding and skills as they relate to the nomenclature of chemical inorganic compounds and simple organic compounds; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 7.0
X-5.317
X-5.320
The student will demonstrate his knowledge, understanding and skills as they relate to gases and laws relating to their behavior; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 8.0
X-5.312
X-5.317
X-5.325

Using a periodic table when necessary, the student will demonstrate his knowledge, understanding and skills as they relate to chemical stoichiometry; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 9.0
X-5.315

The student will demonstrate his knowledge, understanding and skills as they relate to liquids and solids; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 10.0
X-5.317
X-5.319

The student will demonstrate his knowledge, understanding and skills as they relate to solutions; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

T.P.O. 11.0
X-5.316
X-5.317
X-5.318

The student will demonstrate his knowledge, understanding and skills as they relate to chemical reactions (acid-base and simple oxidation-reduction); as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

The following are suggested laboratory experiments coinciding with the T.P.O.'s as written. All labs have been completed with varying degrees of success by students of the writing team. Other lab books are available on the market which would probably replace some of these or you may want to write your own experiments. Lack of time, equipment, or chemicals may not allow all labs to be conducted. Although the labs coincide with each T.P.O., there may be some overlapping of lab and lecture and the order and number of labs required may be changed to better fit your time schedule.

All labs referred to are from Exercises and Experiments in Chemistry: Metcalfe, Williams, Castka, 1970 (accompanies the text Modern Chemistry) unless otherwise indicated.

1.0	Ex. 1	Laboratory procedures
	Ex. 2	Measurement
	Inv. 4	Density of Liquids and solids (Laboratory Investigations in Chemistry, Ferguson et. al: Silver Burdett, 1973)
2.0	Ex. 3	Mixtures and compounds
	Ex. 4	Physical and chemical changes
	Ex. 5	Catalysis
	Ex. 6	Phase change
3.0	Ex. 48	Flame tests
	Ex. 2	Elements and compounds (Laboratory Experiments For An Introduction to Chemistry; Dickson and Healey; Wiley, 1971). Available at F.J.C.
	Inv. 15	Mole Ratios and chemical reactions (Laboratory Investigations in Chemistry)
4.0	Ex. 7	Covalent molecules

5.0	None	
6.0	Ex. 8	Percentage of oxygen in potassium chlorate
7.0	Ex. 12	Boyle's Law (Experimental Chemistry, Geffner and Lauren, Amsco, 1968)
	Ex. 13	Charles' Law (Experimental Chemistry, Geffner and Lauren, Amsco, 1968)
	Inv. 10	The mole and molar volume (Lab. Inv. in Chem.)
	Ex. 14	Replacement of Hydrogen by a metal
	Ex. 15	Molar volume of a gas
	Ex. 16	Molecular weight of a gas
8.0	Ex. 10	Mass Relations in a chemical change
	Ex. 9	Balancing chemical equations
	Ex. 11	Types of chemical reactions
	Ex. 38	Rate of chemical reactions
9.0	Ex. 19	Percentage of water in a hydrate
10.0	Ex. 20	Solutions and molecular polarity
	Ex. 23	A solubility curve
11.0	Ex. 29	Relative strengths of acids and bases
	Ex. 30	Titration of an acid and a hydroxide

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills of measurement, as it relates to the metric system, conversion, and density relationships with related laboratory techniques using metric apparatus; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.1	Given four choices, the student will identify the three basic metric units of measurement.	1.1.1	The basic units of measure in the metric system are: 1. inch, pound, ounce 2. meter, gram, liter 3. inch, cubic centimeter, ounce 4. degree, calorie, gram
1.2	Given four choices, the student will select the correct conversion from milliliters to liters.	1.2.1	The capacity of a Florence flask is 250 ml. How many liters is this? 1. .250 liters 2. 2.50 liters 3. 25 liters 4. 250 liters
1.3	Given a measurement in the English system, the student will select from four choices the metric equivalent.	1.3.1	The number of grams approximately equal to 1 lb. is: 1. 1.06 g. 2. 454 g. 3. 200 g. 4. 16 g.
1.4	Given four choices, the student will choose the appropriate metric apparatus for measuring volume, length, and mass.	1.4.1	Which of the following pieces of apparatus would most accurately measure volume, length, and mass? 1. graduated cylinder, meter stick, triple beam balance 2. beaker, measuring tape, spring balance 3. flask, meter stick, centigram balance 4. graduated cylinder, meter stick, scale

COURSE COURSE

TERMINAL PERFORMANCE OBJECTIVE NO. 1.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
1.5	Given the length, height, width, and mass of an object, the student will identify from four choices the object's density.	1.5	A rectangular slab measuring 5.0 cm long, .02 meters high, and .15 dm high has a mass of 30 grams. What is its density? 1. 2.0 g/cm^3 2. 15 g/cm^3 3. 30 g/cm^3 4. 450 g/cm^3

ANSWER KEY
T.P.O. 1.0

1.1.1	2
1.2.1	1
1.3.1	2
1.4.1	1
1.5.1	1

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to chemical elements and compounds; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.1	Given a list of four substances, the student will identify which of the four is an element.	2.1.1	Which of the following is an element? 1. air 2. water 3. carbon 4. salt
2.2	Given a list of four properties of substances, the student will identify which of the four is a chemical property.	2.2.1	Which of the following is a chemical property? 1. color 2. conductivity 3. density 4. combustion
2.3	Given a list of elements, the student will identify the appropriate symbol from a given list.	2.3.1	From the list given below, choose the correct symbol for the element given. ____ 1. potassium (a) O ____ 2. sulfur (b) Na ____ 3. sodium (c) P ____ 4. chlorine (d) Zn ____ 5. phosphorus (e) I ____ 6. zinc (f) Fe ____ 7. copper (g) Cu ____ 8. iron (h) Co ____ 9. magnesium (i) K ____10. silver (j) Ma (k) Mg (l) S (m) Ag (n) Cl (o) Si

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.4	Given four statements, the student will choose the statement which does not correctly describe the makeup of a compound.	2.4.1	All of the following statements correctly describe a compound except: 1. A compound is made up of atoms. 2. A compound is made up of molecules. 3. A compound is made up of a combination of different kinds of atoms. 4. A compound is made up of a combination of mixtures.
2.5	Given four atomic particles, the student will select the one which causes isotopes of an element to be different from each other.	2.5.1	The isotopes of a given element will have different numbers of: 1. electrons 2. protons 3. neutrons 4. mesons
2.6	From a list of four statements, the student will identify the one that best describes a mole.	2.6.1	Which of the following statements best describes a mole: 1. A mole is the atomic number of an element expressed in ounces. 2. A mole is the isotope number of an element expressed in grams. 3. A mole is the atomic weight of an element expressed in grams. 4. A mole is the Avogadro number expressed in grams.
2.7	Given a Periodic Table, the student will identify from four choices the number of grams in one mole of an element.	2.7.1	The correct number of grams in one mole of sodium is: 1. 23 g. 2. 11 g. 3. 12 g. 4. 32 g.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.8	Given a Periodic Table, the student will identify from four choices the number of moles in a given mass of an element.	2.8.1	The number of moles of sulfur in 64 g. of the element is: 1. one 2. two 3. three 4. four
2.9	Given the Periodic Table, the student will identify from four choices the number of moles in a given mass of a compound.	2.9.1	The number of moles in 36 g. of water is: 1. 2 2. 36 3. 1 4. 18
2.10	Given the Periodic Table, the student will identify from four choices the mass of a given number of moles of a compound.	2.10 .1	The number of grams in one mole of H_2SO_4 is: 1. 7 g. 2. 49 g. 3. 50 g. 4. 98 g.
2.11	Given the Periodic Table, the student will identify from four choices the percent of an element in a given compound.	2.11 .1	The correct percent of silver in Ag_2S is: 1. 100% 2. 13% 3. 87% 4. 48%

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 2.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
2.12	Given a list of five substances, the student will identify their classification as to liquid, monatomic gas, or diatomic gas.	2.12 .1	Match the substances in Column #1 with the classifications given in Column #2. Assume room conditions of temperature and pressure. #1 — #2 ____ 1. Mercury — A. Liquid ____ 2. Hydrogen — B. Monatomic gas ____ 3. Helium — C. Diatomic gas ____ 4. Chlorine ____ 5. Neon

ANSWER KEY
T.P.O. 2.0

2.1.1 3
2.2.1 4
2.3.1

1. i
2. l
3. b
4. n
5. c
6. d
7. g
8. f
9. k
10. m

2.4.1 4
2.5.1 3
2.6.1 3
2.7.1 1
2.8.1 2
2.9.1 1
2.10.1 4
2.11.1 3
2.12.1

1. a
2. c
3. b
4. c
5. b

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to atomic structure; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.1	The student will identify from four choices the definition of the atomic number of an atom.	3.1.1	The atomic number of an atom may be defined as: 1. Sum of protons and neutrons in the nucleus 2. The protons in the nucleus of an atom 3. Difference between the protons and neutrons 4. The number of electrons in an ion
3.2	The student will identify from four statements the one that best describes Bohr's concept of the atom.	3.2.1	The statement that best describes the Bohr concept of the atom is: 1. Electrons constantly gain and lose energy as they move in their energy levels. 2. When an electron moves from a ground state to an excited state, they lose energy. 3. Electrons emit electricity when they return to their ground state. 4. As electrons move in their energy levels, no energy loss occurs.
3.3	Given four choices, the student will identify the statement that best describes energy transitions within an atom.	3.3.1	Energy transitions within an atom occur: 1. by continuous radiation of energy 2. by continuous absorption of energy 3. in jumps of specific amounts of energy 4. by continuous change in energy

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.4	Given four choices, the student will identify the statement that best describes energy emissions from excited atoms.	3.4.1	A bright line spectrum indicates that light emitted by excited atoms has: 1. all wavelengths 2. no wavelengths 3. only very definite wavelengths 4. varying wavelengths
3.5	Given four choices, the student will identify the statement that best describes the location of an electron in an atom.	3.5.1	A highly probable location in which an electron may be found in an atom is described by: 1. its exact location 2. its definite path 3. a space orbital 4. Plank's constant
3.6	Given a list of the four quantum numbers in an atom, the student will identify the appropriate description for each.	3.6.1	Match the quantum numbers in Column #1 with their correct description in Column #2. Column #1 ____ 1. Principal ____ 2. Secondary ____ 3. Magnetic ____ 4. Spin

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.6	Cont'd	3.6.1	Column #2 (a) Relative average distance from the nucleus (b) Spatial orientation (c) Number of electrons in a cloud (d) Shape of orbital (e) Direction electron rotates on its axis
3.7	Given four choices, the student will select the correct number of space orbitals in a sublevel.	3.7.1	The number of space orbitals in sublevel "f" is: 1. one 2. three 3. five 4. seven
3.8	The student will select from four choices the maximum number of electrons in an energy level.	3.8.1	The maximum number of electrons which can be in the 4th energy level is: 1. 50 2. 32 3. 18 4. 8
3.9	Given four choices, the student will identify the correct electron configuration for a particular atom.	3.9.1	The correct electron configuration for the third energy level of phosphorus is: 1. $3s^2$ 2. $3s^2\ 3p^6$ 3. $3s^2\ 3p^3$ 4. $3s^3\ 3p^3$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.10	Given a list of four sublevel blocks, the student will identify the correct location of these blocks from a list of possible locations on the Periodic Table.	3.10 .1	Match the sublevel blocks in Column #1 with their approximate location on the Periodic Table. #1 #2 ___1. s (a) Rare earth elements ___2. p (b) Active metals ___3. d (c) Nonmetals and inert gases ___4. f (d) Transition elements
3.11	Given the name of a family of elements, the student will identify from four choices the group number on the Periodic Table of the given family.	3.11 .1	The halogen family is located in which group on the Periodic Table? 1. I 2. III 3. VII 4. VIII
3.12	Given an element's group number on the Periodic Table, the student will identify from four choices the number of outer energy level electrons for that element.	3.12 .1	Argon is located in group VIII of the Periodic Table and has a total of 18 electrons. How many electrons are in its outer energy level? 1. 8 2. 6 3. 4 4. 3

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 3.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
3.13	Given a Periodic Table, the student will identify from four choices the electron dot notation for a given element.	3.13 .1	The correct electron dot notation for the nitrogen atom is: 1. :N: 2. :N: 3. :N: 4. :N:
3.14	Given four statements, the student will choose the statement which best describes the location of the transition elements on the Periodic Table.	3.14 .1	The statement which best describes the location of the transition elements on the Periodic Table is: 1. The transition elements are located at the bottom of the table. 2. The transition elements are located in the middle of the table. 3. The transition elements are located at the extreme left of the table. 4. The transition elements are located at the extreme right of the table.

ANSWER KEY
T.P.O. 3.0

3.1.1 2
3.2.1 4
3.3.1 3
3.4.1 3
3.5.1 3
3.6.1

1. a
2. d
3. b
4. e

3.7.1 4
3.8.1 2
3.9.1 3
3.10.1

1. b
2. c
3. d
4. a

3.11.1 3
3.12.1 1
3.13.1 3
3.14.1 2

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to chemical bonding; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.1	Given four choices, the student will use the octet rule to identify the number of electrons in the outer energy level associated with chemical stability.	4.1.1	An atom is chemically stable when its outermost energy level is occupied by: 1. 8 electrons 2. 18 electrons 3. 32 electrons 4. 50 electrons
4.2	Given four choices, the student will identify a description of the ionic bond.	4.2.1	A bond in which an electron is transferred from one atom to another is a (an). 1. pure covalent bond 2. polar covalent bond 3. coordinate covalent bond 4. ionic bond
4.3	Given four choices, the student will identify the correct symbol for a given ion.	4.3.1	The correct formula for the magnesium ion is: 1. Mg^{+} 2. Mg° 3. Mg^{++} 4. $Mg^{=}$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

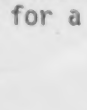
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.4	Given a list of monatomic ions, the student will identify the appropriate symbol of each radical from a given list.	4.4.1	Match the name of the ion in Column #1 with its symbol in Column #2. Column #1 — Column #2 ___ 1. Sulfide — (a) $Ca^{=}$ ___ 2. Oxide — (b) Na^{+} ___ 3. Sodium — (c) K^{+} ___ 4. Calcium — (d) Zn^{+} ___ 5. Zinc — (e) Ca^{++} (f) So^{+} (g) $S^{=}$ (h) $O_2^{=}$ (i) Zn^{++} (j) $O^{=}$ (k) S^{++}
4.5	Given four choices, the student will identify the definition of a covalent bond.	4.5.1	A covalent bond is formed by electron: 1. sharing 2. gaining 3. losing 4. splitting

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.6	Given four choices, the student will identify the type of particle formed by a covalent bond.	4.6.1	The type of particle formed by the formation of a covalent bond is a(an): 1. cation 2. atom 3. molecule 4. anion
4.7	The student will identify from four choices the correct electron dot formula for a given compound.	4.7.1	The correct electron dot structure for water is: 1.  2. 3. 4.
4.8	The student will identify from four choices the number of electrons in a multiple covalent bond.	4.8.1	A double covalent bond is formed when two atoms share how many electrons: 1. 2 2. 4 3. 6 4. 8

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

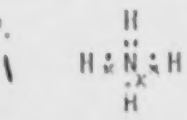
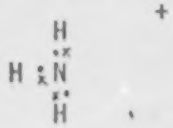
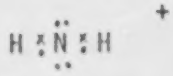
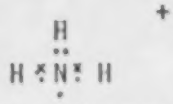
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.9	Given four choices, the student will identify the definition of a radical.	4.9.1	A group of atoms with an electrostatic charge is: 1. a molecule 2. a radical 3. covalent 4. neutral
4.10	Given a list of radicals, the student will identify their appropriate formula and charge.	4.10 .1	Match the radicals in Column #1 with their correct formula and charge in Column #2. Column #1 — Column #2 ___ 1. Hydroxide — (a) MnO_4^- ___ 2. Phosphate — (b) $NO_2^=$ ___ 3. Permanganate — (c) H_3O^+ ___ 4. Hydronium — (d) $PO_4^{\equiv}$ (e) NH_4^+ (f) OH^-

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.11	Given four choices, the student will identify the correct electron dot notation for a radical.	4.11 .1	The correct electron dot notation for the ammonium radical is: 1.  2.  3.  4. 
4.12	Given four choices, the student will identify the definition of electronegativity.	4.12 .1	The attraction of an atom for the shared pair of electrons forming a bond between it and another atom is called: 1. electron affinity 2. ionization energy 3. electronegativity 4. non-polarity
4.13	Given four statements, the student will choose the one which best describes the variation of electronegativities on the Periodic Table.	4.13 .1	The statement which best describes the variation of electronegativities of the elements in the Periodic Table is: 1. Electronegativity increases with increasing atomic number within a group.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

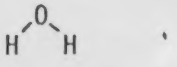
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.13	Cont'd	4.13 .1	Cont'd 2. Electronegativities within a group vary haphazardly. 3. Electronegativities increase with increasing atomic number within a period. 4. Electronegativity tends to decrease within the Periodic Table.
4.14	Given four choices, the student will choose the statement which best describes a pure covalent bond.	4.14 .1	A bond in which there is an equal attraction for the shared electrons by the bonded atoms is: 1. an ionic bond 2. a pure covalent bond 3. a polar covalent bond 4. a coordinate covalent bond
4.15	Given a list of molecules, the student will identify the one which is non-polar.	4.15 .1	Which of the following is <u>not</u> a polar molecule? 1. water 2. hydrogen chloride 3. ammonia 4. carbon tetrachloride
4.16	Given four choices, the student will identify the one statement that does <u>not</u> describe a polar molecule.	4.16 .1	All of the following statements are typical of polar molecules <u>except</u>: 1. There is a separation of the center of positive and negative charge. 2. The attractive forces are stronger than Van der Waals forces. 3. They exist as gases at room conditions. 4. The shared electron pair is arranged unsymmetrically between the bonded atoms.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 4.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
4.17	Given four choices, the student will select the correct structural formula for the water molecule.	4.17 .1	The correct structural formula for water is: 1. H - H - O 2. H - O - H 3. H | H - O 4. 
4.18	Given a particular electronegativity value (high or low), the student will identify from four choices the class of elements having that electronegativity characteristic.	4.18 .1	Of the following elements, which would have the highest electronegativity? 1. metals 2. nonmetals 3. transition elements 4. rare earth elements

ANSWER KEY
T.P.O. 4.0

4.1.1 1
4.2.1 4
4.3.1 3
4.4.1

1. G
2. J
3. B
4. E
5. I

4.5.1 1
4.6.1 3
4.7.1 1
4.8.1 2
4.9.1 2
4.10.1

1. F
2. E
3. A
4. C

4.11.1 1
4.12.1 3
4.13.1 3
4.14.1 2
4.15.1 4
4.16.1 3
4.17.1 4
4.18.1 2

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to the periodic properties of the elements with use of the Periodic Table when applicable; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.1	Given a partial definition of the Periodic Law, the student will select from four choices the answer which best completes the definition.	5.1.1	The Periodic Law states that chemical properties are periodic functions of their: 1. atomic mass 2. atomic number 3. atomic weight 4. mass number
5.2	Given four statements, the student will choose the one which does not describe ionization energy.	5.2.1	All the following statements concerning ionization energy are true except: 1. Low ionization energy is characteristic of metals. 2. Within a group of elements the ionization energy generally decreases with increasing atomic number. 3. The ionization energy of the Noble Gases is extremely low. 4. Ionization energy does not vary uniformly from element to element within a period, but is a periodic property.
5.3	Given four choices, the student will identify the statement which best describes why the ionization energy of the elements varies within a group on the Periodic Table.	5.3.1	The general decrease in ionization energy with increasing atomic number within the numbered groups of elements may be explained on the basis of: 1. increase in atomic radius and electron interference (shielding effect). 2. decreasing number of protons. 3. increasing number of neutrons. 4. increasing number of electrons in "d" sublevels.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.4	Given four choices, the student will identify how ionization energy changes in a period with increasing atomic number.	5.4.1	The increase in the ionization energy in period #2 as the atomic number increases may be explained by which statement. 1. The nucleus contains more neutrons. 2. The outer energy level electrons are more tightly held because the nucleus contains more protons. 3. Electrons are being added to the energy level. 4. More orbitals are being added.
5.5	Given four choices, the student will identify the trend in the size of atoms in a group as related to their atomic number.	5.5.1	As the atomic number of the elements in a group increases, the atomic radius of the successive elements: 1. decreases only 2. increases only 3. increases then decreases 4. remains the same
5.6	Given four choices, the student will identify the trend in the size of atoms in a period as related to their atomic number.	5.6.1	In period #3, as the atomic number increases from Group I to Group VII, the atomic radius: 1. decreases 2. increases 3. increases then decreases 4. remains the same
5.7	Given four choices, the student will identify the statement that best describes the relationship between the size of an atom and its ion.	5.7.1	The statement which best describes the size of the sodium atom relative to the size of its ion is: 1. The sodium atom is smaller than its ion.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.7	Cont'd	5.7.1	Cont'd 2. The sodium ion is larger than its atom. 3. The sodium ion is smaller than the sodium atom. 4 The sodium atom is smaller than its positive ion.
5.8	Given a list of elements, the student will identify the group of four elements which exists naturally as diatomic molecules.	5.8.1	Which of the following groups of four elements exist naturally as diatomic molecules: 1. helium, neon, argon, krypton 2. chlorine, oxygen, nitrogen, hydrogen 3. carbon, silicon, tin, lead 4. sodium, potassium, lithium, rubidium
5.9	From a list of four choices, the student will identify the common oxidation number of hydrogen and oxygen.	5.9.1	The common oxidation number of hydrogen is: 1. +1 2. +2 3. -1 4. -2
		5.9.2	The common oxidation number of oxygen is: 1. +1 2. +2 3. -1 4. -2

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.10	Given four choices, the student will identify the correct oxidation number of an ion when given the oxidation numbers of the other elements present.	5.10 .1	In the compound, $MgBr_2$, the correct oxidation number for magnesium is +2. Therefore, the correct oxidation number for bromine in this compound is: 1. 0 2. +1 3. -2 4. -1
5.11	Given a list of elements, the student will identify the most common oxidation state of those elements.	5.11 .1	Match the elements in Column #1 with their most common oxidation number as ions in Column #2. Column #1 / Column #2 ___ 1. Potassium (a) 0 ___ 2. Zinc (b) +1 ___ 3. Carbon (c) -1 ___ 4. Sulfur (d) +2 ___ 5. Fluorine (e) -2 (f) +3 (g) -3 (h) +4
5.12	Given the name of a compound, the student will select from four choices the correct formula for the compound.	5.12	The correct formula for the compound sodium sulfide is: 1. Na S 2. Na_2S 3. $Na\ S_2$ 4. Na_2S_2

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 5.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
5.13	Given four choices, the student will identify the location of a metalloid on the Periodic Table.	5.13 .1	The elements which border the zigzag line running diagonally down and to the right end of the Periodic Table are: 1. Noble gases 2. metals 3. nonmetals 4. metalloids
5.14	Given four choices, the student will choose the statement which best explains the size of atoms in a group on the Periodic Table.	5.14 .1	The dominant factor in determining the variation in size of successive atoms in a group is the: 1. increase in nuclear charge 2. increase in number of neutrons 3. decrease in the radii of electron energy levels 4. addition of an energy level
5.15	Given four choices, the student will identify the definition of electron affinity.	5.15 .1	The net energy change when an electron is added to a neutral atom is known as the element's: 1. electron affinity 2. ionization energy 3. atomic number 4. electronegativity

ANSWER KEY

T.P.O. 5.0

5.1.1 2
5.2.1 3
5.3.1 1
5.4.1 2
5.5.1 b
5.6.1 a
5.7.1 3
5.8.1 2
5.9.1 1
5.9.2 4
5.10.1 4
5.11.1

1. B
2. D
3. H
4. E
5. C

5.12.1 2
5.13.1 4
5.14.1 4
5.15.1 1

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. After having memorized a table of common ions and their charges, the student will demonstrate his knolwedge, understanding, and skills as they relate to the nomenclature of chemical inorganic compounds and simple organic compounds; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.1	Given the formula of a binary compound involving a metal of invariant oxidation number and a nonmetal, the student will identify the name from four choices.	6.1.1	What is the name of the compound whose chemical formula is MgI_2? 1. manganese iodide 2. manganese iodine 3. magnesium ironide 4. magnesium iodide
6.2	Given the name of a binary compound involving a metal and nonmetal, the student will identify its formula from four choices.	6.2.1	The formula for potassium oxide is: 1. K_2O 2. K_2O_2 3. P_2O 4. P_2O_2
6.3	Given the formula of a binary compound of a metal and nonmetal, the student will identify its name from four choices, using the stock method.	6.3.1	What is the name of the compound whose formula is FeS? 1. ferric sulfide 2. ferrous sulfide 3. ferric sulfite 4. ferrous sulfite
6.4	Given four choices, the student will select the correct formula for a binary compound when given the stock name.	6.4.1	The correct formula for cupric chloride is: 1. Cu_2Cl 2. $CuCl$ 3. $CuCl_2$ 4. Cu_2Cl_2

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.5	Given four choices, the student will select the correct name of a nonmetal - nonmetal binary compound when given the chemical formula.	6.5.1	The correct name for the compound, As_2O_3, is: 1. arsenic trioxide 2. biarsenic oxide 3. arsenic oxide 4. diarsenic trioxide
6.6	Given four choices, the student will select the correct formula for a nonmetal - nonmetal binary compound when given the correct name.	6.6.1	The correct formula for dinitrogen monoxide is: 1. NO 2. N_2O 3. N_2O_2 4. NO_2
6.7	Given the formula of a compound involving a metal and a polyatomic ion, the student will identify from four choices the correct name of the given compound.	6.7.1	The correct name for the compound which has the formula, $PbSO_4$, is: 1. lead (III) sulfite 2. mercury (III) sulfate 3. lead (II) sulfate 4. mercury (II) sulfite
6.8	Given the name of a compound involving a metal and a polyatomic ion, the student will identify from four choices the correct formula of the given compound.	6.8.1	Iron (III) carbonate has the formula: 1. Fe_3CO_3 3. Fe_2CO_3 2. $Fe_3(CO_3)_3$ 4. $Fe_2(CO_3)_3$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.9	Given a formula for an acid, the student will identify from four choices the correct name of the given acid.	6.9.1	The correct name for the acid which has the formula, H_2SO_4, is: 1. hydrosulfuric acid 2. sulfuric acid 3. sulfurous acid 4. hyposulfurous acid
6.10	Given four choices, the student will select the correct formula for an oxyacid when given the name.	6.10 .1	The correct formula for phosphoric acid is: 1. H_3P 2. H_3PO_2 3. H_3PO_3 4. H_3PO_4
6.11	Given four choices, the student will select the correct name of an oxyacid when given the formula.	6.11 .1	The name of the acid, $HClO_3$, is: 1. perchloric acid 2. chloric acid 3. chlorous acid 4. hypochlorous acid
6.12	Given four choices, the student will select the correct name of an oxyanion when given the formula.	6.12 .1	The correct name of the ion, ClO^-, is: 1. perchlorate 2. chlorate 3. chlorite 4. hypochlorite

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.13	Given the formula for a compound containing an oxyanion, from four choices the student will identify its name.	6.13 .1	The name of the compound whose formula is $HClO_4$, is: 1. hypochlorous acid 2. chlorous acid 3. chloric acid 4. perchloric acid
6.14	Given the formula of a hydrate, the student will select its correct name from four choices.	6.14 .1	The correct name of the compound which has the formula, $CuSO_4 \cdot 5H_2O$, is: 1. copper (II) sulfate pentahydrate 2. cuprous sulfate pentahydrate 3. copper (III) sulfate tetrahydrate 4. cupric sulfate anhydride
6.15	Given the name of a hydrate, the student will select its correct formula from four choices.	6.15 .1	The correct formula for calcium chloride di-hydrate is: 1. $CaCl_2 \cdot 2H_2O$ 2. $CaCl \cdot 8H_2O$ 3. $CaCl_3 \cdot 5H_2O$ 4. $CaCl_2 \cdot 6H_2O$
6.16	Given a Periodic Table and the percentage composition of a compound, the student will choose its empirical formula from four choices.	6.16 .1	The empirical formula of a compound which contains 80% carbon + 20% hydrogen is: 1. CH 2. CH_3 3. C_3H 4. CH_4

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

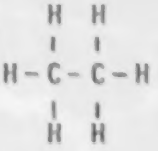
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.17	Using the results of the preceding problem, the molecular weight of the given compound, and a Periodic Table, the student will identify the molecular formula of the compound from four choices.	6.17 .1	If the molecular weight of the gas in the preceding problem is 26.0 a.m.u.'s, what is its molecular formula? 1. C_2H_6 2. C_2H_2 3. C_3H_6 4. C_2H_8
6.18	Given the formulas of the reactants and products, the student will balance a simple chemical equation by identifying the missing coefficient from four choices.	6.18 .1	When the equation: $Al_2(SO_4)_3 + Ca(OH)_2 \longrightarrow$ $Al(OH)_3$ (s) + $CaSO_4$ (s) is correctly balanced, the coefficient in front of the $Ca(OH)_2$ is: 1. 1 2. 2 3. 3 4. 4
6.19	Given a chemical formula for a compound, the student will select from four choices the correct gram formula weight, using a Periodic Table.	6.19 .1	The correct gram formula weight for $CaCO_3$ is: 1. 304 g. 2. 114 g. 3. 100 g. 4. 72 g.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

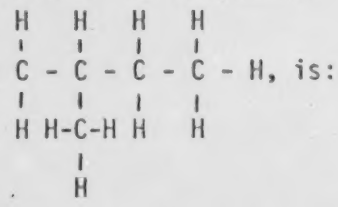
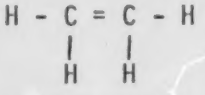
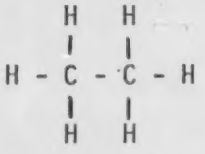
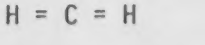
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.20	Using the results in the preceding problem and the Periodic Table, the student will select from four choices the correct percentage of a given element in a compound.	6.20 .1	The percentage of calcium in the compound $CaCO_3$ is: 1. 40% 2. 12% 3. 48% 4. 20%
6.21	Given four choices, the student will identify the definition of organic chemistry.	6.21 .1	The chemistry dealing with the study of carbon-containing compounds is: 1. physical chemistry 2. organic chemistry 3. inorganic chemistry 4. analytical chemistry
6.22	Given four choices, the student will select the correct structural formula for a specified organic compound.	6.22 .1	Of the following, the one that is the structural formula for ethane is: 1. C_2H_6 2.  3. 4. CH_3CH_3

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

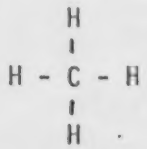
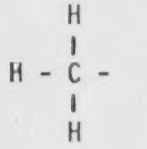
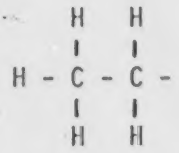
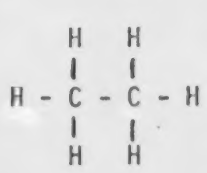
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.23	Given a structural formula for an organic compound, the student will select the correct name from four choices.	6.23 .1	The name of the compound,  1. 3-methyl butane 2. 2-methyl butane 3. 2-methyl pentane 4. 2-pentane
6.24	Given four choices, the student will select the formula which represents a specified organic family.	6.24 .1	Of the compounds listed below, the one which is an alkyne is: 1.  2.  3. 4. 

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 6.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
6.25	Given four choices, the student will select the correct structural formula for a specified alkyl group.	6.25 .1	The correct structural formula for the ethyl group is: 1.  2.  3.  4. 

ANSWER KEY
T.P.O. 6.0

6.1.1	4
6.2.1	1
6.3.1	2
6.4.1	3
6.5.1	4
6.6.1	2
6.7.1	3
6.8.1	4
6.9.1	2
6.10.1	3
6.11.1	2
6.12.1	4
6.13.1	4
6.14.1	1
6.15.1	1
6.16.1	2
6.17.1	1
6.18.1	3
6.19.1	3
6.20.1	1
6.21.1	2
6.22.1	2
6.23.1	2
6.24.1	1
6.25.1	3

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to gases and laws relating to their behavior; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.1	Given four statements, the student will identify the one which best describes the volume of a gas.	7.1.1	Which of the following statements best describes the volume of a gas: 1. Gas volume is negligible. 2. Gas volume is measured in millimeters. 3. Gas volume is dependent on temperature and pressure. 4. Gas volume increases as the barometer reading increases.
7.2	Given four choices, the student will identify the one which is <u>not</u> a characteristic of gas molecules as stated in the kinetic molecular theory.	7.2.1	According to the kinetic theory, gas molecules have all the following characteristics <u>except</u> that of: 1. moving rapidly in random fashion 2. filling whatever space is available to them 3. being widely separated 4. having strong attractive forces between molecules
7.3	Given four statements, the student will choose the one that best describes how a gas exerts pressure.	7.3.1	Pressure is exerted by a gas due to: 1. collision of molecules with each other 2. collision of molecules with the walls of their container 3. molecules escaping from their container 4. molecules entering their container.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.4	Given four choices, the student will correctly identify the algebraic expression for the Ideal Gas Law.	7.4.1	The correct algebraic expression for the Ideal Gas Law is: 1. PV = nRT 2. PT = nVR 3. PR = VTn 4. TV = nRP
7.5	Given four choices, the student will identify the correct unit for a term from the Ideal Gas Law.	7.5.1	The letter "n" in the Ideal Gas Law represents: 1. pressure (atm.) 2. moles 3. temperature (K°) 4. volume (liters)
7.6	Given four choices, the student will select the term which best identifies a barometer.	7.6.1	An instrument which is used to measure air pressure is a(an): 1. manometer 2. calorimeter 3. barometer 4. thermometer
7.7	Given four choices, the student will choose the correct correlation between one atmosphere and its equivalence in millimeters.	7.7.1	One atmosphere is equivalent to: 1. 75.0 m. 2. 760 mm. 3. 745 cm. 4. 740 m.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.8	Given four choices, the student will identify the correct value of the gas constant "R" in liters-atm/mole-°K is:	7.8.1	The numerical value of the gas constant "R" in liters-atm/mole-°K is: 1. 16.0 2. 22.4 3. 6.02 4. 0.0821
7.9	Given four choices, the student will select the number of moles of a gas when given the volume, temperature, and pressure.	7.9.1	How many moles of chlorine gas are contained in a 5.0 l. flask at 20° C. and 600 mm. pressure? 1. .164 2. 1.64 3. 16.4 4. 164
7.10	Given four choices, the student will select the one which defines standard conditions.	7.10 .1	Standard conditions may be defined as: 1. 300° K and 1 atm. 2. 760 mm. and 0° K 3. 0° C. and 273 mm. 4. 273° K and 760 mm.
7.11	Given four choices, the student will select the correct value for the molar volume of a gas.	7.11 .1	The volume of 1 mole of a gas at standard conditions of temperature and pressure is: 1. 6.02×10^{23} liters 2. 22.4 liters 3. 67.2 liters 4. 760 liters

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.12	The student will identify from four choices the correct definition of Boyle's Gas Law.	7.12 .1	Boyle's Gas Law states: 1. The volume of a gas is dependent on temperature and pressure, provided the number of moles remains constant. 2. The volume of a gas varies directly with the Kelvin temperature with pressure constant. 3. The volume of a gas varies inversely with the pressure applied on the gas with temperature constant. 4. The volume of a gas is dependent on the number of gas molecules in the container, provided the temperature and pressure remain constant.
7.13	The student will identify from four choices the correct definition of Charles' Gas Law.	7.13 .1	Charles' Gas Law states: 1. Gas volume varies directly with the Celsius temperature provided the pressure is constant. 2. Gas volume varies indirectly with the Kelvin temperature, provided pressure is constant. 3. Gas volume varies directly with the pressure on the gas, provided temperature is constant. 4. Gas volume varies directly with the Kelvin temperature, provided the pressure is constant.
7.14	Given four choices, the student will use the basic gas laws (Boyle's or Charles') to determine the new condition (V, P, or T) of a gas corresponding to a given change in conditions.	7.14 .1	A gas measures 500 ml. at a temperature of -23° C. What will be its volume in ml. at 23° C? 1. 5.92 ml. 3. 592 ml. 2. 59.2 ml. 4. 5920 ml.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.15	Given four choices, the student will use the combined gas law to determine the new volume of a gas corresponding to a given change in conditions.	7.15 .1	A gas measured 2280 ml. at 30° C. and 808 mm. pressure. Find the volume at standard conditions. 1. 2.18 ml. 2. 21.8 ml. 3. 218 ml. 4. 2180 ml.
7.16	Given a partial definition of Dalton's Law of Partial Pressure, the student will select from four choices the answer which best completes the definition.	7.16 .1	Dalton's Law of Partial Pressure states that the total pressure of a mixture of gases is equal to the: 1. product of their partial pressures 2. sum of their partial pressures 3. difference in their partial pressures 4. percentage difference of each gas
7.17	Given the temperature, barometric pressure, and water vapor pressure of a gas collected over water, the student will identify the partial pressure of the dry gas from four choices.	7.17 .1	Oxygen is collected in a eudiometer over water. The water level inside the tube is the same as that outside. The temperature is 25.0° C. and the barometric pressure is 740.0 mm. What is the partial pressure of the dry oxygen gas? The pressure of water vapor at 25° C. is 23.8 mm. 1. 765.0 mm. 2. 763.8 mm. 3. 716.2 mm. 4. 715.0 mm.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.18	Given the volume, temperature, barometric pressure, and water vapor pressure of a gas collected over water, the student will identify the correct volume occupied by the gas at S.T.P. from four choices.	7.18 .1	A gas-measuring tube contains 40 ml. of air collected over water at a temperature of 20.0° C. The water level inside the eudiometer is 27.2 mm. higher than that outside. The barometer reads 740.0 mm. What is the volume of the gas at S.T.P? The water vapor pressure at 20.0° C. is 17.5 mm. 1. 351 ml. 2. 396 ml. 3. 404 ml. 4. 455 ml.
7.19	Given the density, temperature, and pressure of a gas, the student will select the density of the gas at S.T.P. from four choices.	7.19 .1	The density of a gas is 1.293 g/l at 25° C., and 740 mm. pressure. What is the density of the gas at S.T.P? 1. 2.25 g/l 2. 1.45 g/l 3. 2.90 g/l 4. 3.56 g/l
7.20	Given four choices, the student will select the one which is not a property of a gas.	7.20 .1	Which of the following is not a property of a gas? 1. diffusion 2. pressure 3. low density 4. definite volume

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.21	The student will select, from four choices, the one which correctly lists the three most common temperature scales.	7.21 .1	Which of the following lists the three most common temperature scales? 1. Mole, Calorie, Degree 2. Celsius, Fahrenheit, Kelvin 3. Torricelli, Charles, Boyle 4. Henry, Pascal, Dalton
7.22	Given the density of a gas, the student will identify from four choices the mass of one mole of the gas.	7.22 .1	The density of a certain gas at S.T.P. is 1.25 g/l. The mass of one mole of the gas is: 1. 1.25 g. 2. 6.02 g. 3. 22.4 g. 4. 28.0 g.
7.23	The student will identify from four statements, the one which best describes the difference between heat and temperature.	7.23 .1	Which of the following statements best describes the difference between heat and temperature? 1. Heat is measured in degrees and temperature is measured in calories. 2. Heat and temperature are terms which can be used interchangeably. 3. Heat is a form of energy and temperature is a measure of heat energy. 4. Temperature is a measure of the quantity of energy of a body and heat is a measure of the hotness or coldness of a body.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 7.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
7.24	Given a temperature reading on the Celsius scale, the student will select from four choices the corresponding Kelvin temperature.	7.24 .1	The Kelvin temperature which is equivalent to 20° C. is: 1. 293° K. 2. 253° K. 3. 100° K. 4. 120° K.

ANSWER KEY
T.P.O. 7.0

7.1.1	3
7.2.1	4
7.3.1	2
7.4.1	1
7.5.1	2
7.6.1	3
7.7.1	2
7.8.1	4
7.9.1	1
7.10.1	4
7.11.1	2
7.12.1	3
7.13.1	4
7.14.1	3
7.14.2	3
7.15.1	4
7.16.1	2
7.17.1	3
7.18.1	1
7.19.1	2
7.20.1	4
7.21.1	2
7.22.1	4
7.23.1	3
7.24.1	1

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. Using a Periodic Table when necessary, the student will demonstrate his knowledge, understanding, and skills as they relate to chemical stoichiometry; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.1	Given four choices, the student will select the number of moles of one reactant which will react with a second reactant when given the correct chemical equation.	8.1.1	The number of moles of oxygen molecules reacting with 4 moles of aluminum atoms in the equation $4Al + 3O_2 \longrightarrow 2Al_2O_3$ is: 1. 1 2. 2 3. 3 4. 6
8.2	Given four choices, the student will identify the correct molar ratios from a given balanced equation.	8.2.1	In the reaction $2Na + 2H_2O \longrightarrow 2NaOH + H_2$, the correct mole ratio of reactants and products is: 1. 2 : 2 : 2 : 1 2. 2 : 1 : 2 : 1 3. 1 : 2 : 2 : 2 4. 1 : 1 : 2 : 2
8.3	Given four choices, the student will select the number of moles of a species involved with a specific number of moles of a second species (Moles to moles calculations).	8.3.1	How many moles of oxygen would be needed to react with .50 moles of zinc to produce zinc oxide? 1. .25 2. .50 3. .1 4. 2

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.4	Given a balanced chemical equation and the number of moles of one reacting species, the student will identify from four choices the correct mass of a second given species involved in the reaction.	8.4.1	Zinc reacts with sulfuric acid according to the equation $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2\uparrow$. Approximately how many grams of sulfuric acid are required to produce 0.50 moles of H_2? 1. 1.0 g. 2. 2.0 g. 3. 98 g. 4. 49 g.
8.5	Given the reactants and products for a chemical reaction and the mass of one species involved, the student will identify from four choices the correct mass of a second given species.	8.5.1	In the reaction between sulfur and oxygen, 80.0 g. of sulfur dioxide is formed. How many grams of sulfur were burned? 1. 32.1 g. 2. 80.2 g. 3. 40.1 g. 4. 64.1 g.
8.6	Given four choices, the student will select the volume of a gas at specified conditions involved in a reaction with a specific mass or number of moles of a substance.	8.6.1	How many liters of oxygen at S.T.P. would be needed to react with 12 g. of magnesium to produce magnesium oxide? 1. 44.8 l. 2. 22.4 l. 3. 11.2 l. 4. 5.6 l.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.7	Given four choices, the student will select the volume of the gas involved in a reaction with a specific volume of a given gaseous substance.	8.7 .1	Carbon monoxide burns in oxygen to form carbon dioxide. How many liters of carbon dioxide are produced when 15 liters of carbon monoxide burns? 1. one liter 2. two liters 3. 15 liters 4. 44.8 liters
8.8	The student will select from four choices the correct definition of Avogadro's hypothesis.	8.8 .1	The Avogadro's hypothesis states that: 1. The volume of reacting gases and their products can be expressed in a ratio of small whole numbers provided the volumes are measured at the same temperature and pressure. 2. At the same temperature and pressure equal volumes of gas contain equal numbers of molecules. 3. The rate of diffusion of a gas is inversely proportional to the square root of its molecular weight. 4. The solubility of a gas is directly proportional to the pressure applied to the gas.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 8.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
8.9	Given the actual and theoretical yield of a product in a chemical reaction, the student will choose the correct percentage error of the experiment, from four choices.	8.9.1	A student is performing an experiment entitled mass relations in a chemical change. In the experiment 2.00 grams of copper was placed in a crucible with excess sulfur and heated to constant mass. The mass of the resulting product of copper (II) sulfide was found to be 2.75 grams. After computing the theoretical yield as 2.69 grams, what value would the student give as his percentage error? 1. 21.0 % 2. 6.00 % 3. 2.13 % 4. 0.60 %
8.10	Given four choices, the student will indicate the direction of the enthalpy change in a reaction.	8.10 .1	The thermochemical equation for the decomposition of water is: 1 mole H_2O + 222 K cal. $\longrightarrow$ 2 moles H + 1 mole O. The enthalpy factor: 1. increases 2. decreases 3. remains the same 4. varies haphazardly

T.P.O. 8.0
ANSWER KEY

8.1.1	3
8.2.1	1
8.3.1	1
8.4.1	4
8.5.1	3
8.6.1	4
8.7.1	3
8.8.1	2
8.9.1	3
8.10.1	1

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to liquids and solids; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.1	Given a list of four statements, the student will select the one that does not state when Van der Waals forces are significant.	9.1.1	Van der Waals forces become significant when gas molecules exhibit all of the following <u>except</u>: 1. high pressure 2. low density 3. temperatures near their condensation point 4. at the critical temperature and pressure
9.2	Given a list of four choices, the student will select the one that exhibits hydrogen bonding.	9.2.1	When the hydrogen end of one water molecule bonds to the oxygen end of an adjacent water molecule, what type of bond is formed? 1. hydrogen 2. covalent 3. oxygen 4. coordinate covalent
9.3	The student will identify from four choices, the characteristic which is <u>not</u> true of liquids.	9.3.1	Which of the following is <u>not</u> a characteristic of a liquid? 1. Collisions of molecules are elastic. 2. The particles are in constant motion. 3. The particles vibrate in fixed positions. 4. The attractive forces are stronger than those among gas molecules.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.4	The student will identify from four choices the correct definition of the critical temperature of a gas.	9.4.1	The highest temperature at which it is possible to liquefy a gas with any amount of pressure is called its: 1. boiling point 2. triple point 3. condensation temperature 4. critical temperature
9.5	The student will select from four choices the correct definition of the critical pressure of a gas.	9.5.1	The critical pressure of a gas can be defined as: 1. The pressure required to liquefy a gas at its critical temperature. 2. The pressure required to liquefy one mole of a gas. 3. The pressure required to liquefy 22.4 l. of a gas. 4. The pressure required to liquefy 6.02×10^{23} gas molecules.
9.6	Given four choices, the student will select the statement which best completes the description of the process of evaporation.	9.6.1	Evaporation occurs because: 1. Some molecules in a liquid have less energy than others and are therefore forced to leave the container. 2. Some molecules acquire sufficient kinetic energy to escape continually from the surface. 3. The liquid heats up, thus increasing surface tension. 4. The density of the liquid must decrease due to the increasing energy of the molecules toward the bottom of the container.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.7	Given four choices, the student will identify the definition of vapor pressure.	9.7.1	The pressure of the vapor in dynamic equilibrium with a liquid at a given temperature is called the: 1. equilibrium pressure 2. gas pressure 3. vapor pressure 4. liquid pressure
9.8	The student will identify from four choices the statement which best describes the boiling point of a liquid.	9.8.1	The boiling point of a liquid can be best described as: 1. The temperature necessary to warm one gram of the liquid one degree Celsius. 2. The temperature at which the equilibrium vapor pressure is equal to the prevailing atmospheric pressure. 3. The temperature at which the rate of evaporation exists in equilibrium with the rate of condensation. 4. The temperature at which it is possible to evaporate a liquid with any amount of pressure.
9.9	The student will select from four choices, the statement which best describes the freezing process of a liquid.	9.9.1	Which of the following is true of the freezing process? 1. The particles become arranged in definite patterns which have fixed positions in space. 2. The attractive forces between particles decrease. 3. The kinetic energy of the particles increases. 4. The motion of the particles becomes more rapid and random.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

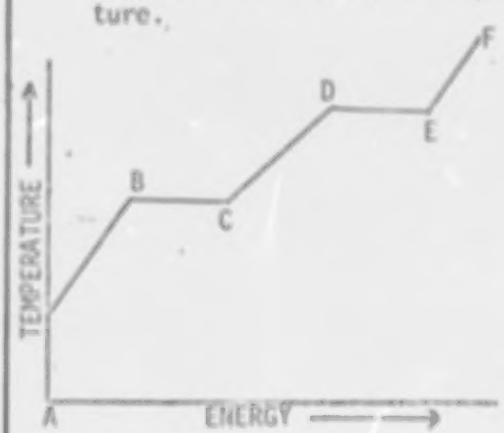
NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.10	Given four types of binding forces between substances, the student will identify the crystal which has that particular binding force.	9.10 .1	Match the type binding force in Column #1 with the type crystal in Column #2. Column #1 — Column #2 __ 1. Strong bonds of positive & negative charges — (a) Metallic __ 2. Strong covalent bonds of shared electrons. — (b) Molecular __ 3. Attraction between the positive ions and the electron cloud. — (c) Covalent __ 4. Relatively weak Van der Waals forces. — (d) Ionic (e) Cubic
9.11	Given a list of four terms relating to energy changes involved when matter changes from one phase to another, the student will identify the statement which best describes that energy change.	9.11 .1	Match the terms in Column #1 with their definition in Column #2. Column #1 ___ 1. Heat of fusion ___ 2. Heat of vaporization ___ 3. Heat of condensation ___ 4. Heat of crystallization Column #2 (a) The heat required to vaporize 1 g. of a substance at its boiling point. (b) The heat required to melt 1 g. of a particular solid.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.11	Cont'd	9.11 .1	Cont'd (c) The amount of heat evolved when a certain amount of liquid is solidified at a certain temperature. (d) The amount of heat evolved when a certain amount of vapor condenses at a certain temperature.
9.12	Given a graph showing changes of state of water, the student will identify from three choices the energy change and state at points on the graph.	9.12 .1	 The graph above represents the changes of state of water. Use this graph to answer the next 2 questions. 1. As the energy increases, the temperature increases in the region: 1. B-C 2. C-D 3. D-E

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 9.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
9.12	Cont'd	9.12 .1	c. Water exists only as a vapor between the points: 1. C-D 2. D-E 3. E-F
9.13	Given four choices, the student will identify the type crystal formed between certain metals and nonmetals.	9.13 .1	Generally speaking, compounds consisting of Group I or Group II metals with the Group VI or Group VII nonmetals, are: 1. ionic crystals 2. covalent crystals 3. metallic crystals 4. molecular crystals

ANSWER KEY
T.P.O. 9.0

9.1.1 2
9.2.1 1
9.3.1 3
9.4.1 4
9.5.1 1
9.6.1 2
9.7.1 3
9.8.1 2
9.9.1 1
9.10.1

(1) d
(2) c
(3) a
(4) b

9.11.1

(1) b
(2) a
(3) d
(4) c

9.12.1 2
9.12.2 3
9.13.1 1

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to solutions; as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.1	Given four choices, the student will correctly identify the definition of solute or solvent.	10.1 .1	The dissolving medium in a solution is the: 1. solute 2. suspended phase 3. solvent 4 precipitate
10.2	The student will identify from four choices the correct definition of molarity.	10.2 .1	The number of moles of solute per liter of a solution is defined as: 1. normality 2. molarity 3. molality 4. solubility
10.3	Given specified data (mass and volume), the student will select from four choices the correct molarity of a solution.	10.3 .1	117 grams of NaCl are dissolved in enough water to make one liter of solution. What is the molarity of the resulting solution? 1. 1 M. 2. 1.5 M. 3. 2.5 M. 4. 2 M.
10.4	Given four choices, the student will select the correct number of moles in a specified volume of solution.	10.4 .1	How many moles of calcium chloride will there be in 200 ml. of a .25 M. solution? 1. 5.0 moles 2. .5 moles 3. .05 moles 4. .005 moles

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.5	Given four choices, the student will select the correct volume needed to contain a specified number of moles.	10.5 .1	How many ml. of .5 M. sodium chloride would be needed to furnish .25 moles to a reaction? 1. 250 ml. 2. 500 ml. 3. 750 ml. 4. 1000 ml.
10.6	Given four choices, the student will identify the number of grams of solute needed to prepare a specific volume of a solution of specified molarity.	10.6 .1	How many grams of calcium carbonate are needed to make 500 ml. of a 1 molar solution? 1. 5 g. 2. 50 g. 3. 100 g. 4. 500 g.
10.7	Given four choices, the student will identify the percentage by mass of a solution component using specified data.	10.7 .1	A solution is made by dissolving 5.0 g. of NaCl in 100.0 g. of water. What is the percent composition by mass of sodium chloride in the solution? 1. 5% 2. 20% 3. 50% 4. 100%
10.8	Given four statements, the student will select the statement which best completes the definition of molality.	10.8 .1	A 1-molal solution is defined as: 1. 1 mole of solvent in 1000 ml. of water 2. 1 mole of solute dissolved in 1000 g. of water 3. 1000 g. of solute dissolved in 1 liter of water 4. 1 mole of solute dissolved in 1 liter of solution

COURSE CHEMISTRY

TERMINAL PEPFORMANCE OBJECTIVE NO. 10.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.9	Given four choices, the student will select the correct molality of a specified solution.	10.9 .1	Find the molality of 49 g. of sulfuric acid dissolved in 1000 g. of water. 1. .25 2. .50 3. 1.0 4. 1.5
10.10	The student will select from four choices the statement which best describes the interaction between water molecules and ions dissolved in water.	10.10 .1	Which of the following best describes the interaction between water molecules and ions dissolved in water? 1. The water molecules change the ions into molecules. 2. The positive ions are attracted to the hydrogen ends of the water molecules. 3. The negatively charged ions are attracted to the hydrogen ends of the water molecules. 4. Hydrogen bonds form between water molecules and the ions.
10.11	Given four statements concerning the dissolving process, the student will choose the one which does not correctly describe dissolving.	10.11 .1	All of the following describe the dissolving process except: 1. Solute particles must be separated from the solid mass. 2. Solvent particles must be moved apart to allow solute particles to enter the liquid environment. 3. Chemical action must occur between solute and solvent before dissolving can take place. 4. Solute particles are attracted to solvent particles.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.12	Given four choices, the student will select the one that best represents a state of dynamic equilibrium.	10.12 .1	The equation which represents a state of dynamic equilibrium occurring in a confined space is: 1. liquid + energy $\longrightarrow$ vapor 2. vapor $\longrightarrow$ liquid + energy 3. liquid + energy $\rightleftharpoons$ vapor 4. liquid $\rightleftharpoons$ vapor + energy
10.13	Given a list of basic terms used to describe solutions, the student will identify them with their appropriate definition.	10.13 .1	Match the following terms in Column #1 with their definitions in Column #2. Column #1 ___ 1. solubility ___ 2. saturated solution ___ 3. unsaturated solution ___ 4. weak electrolyte ___ 5. strong electrolyte ___ 6. supersaturated solution ___ 7. nonelectrolyte Column #2 (a) Contains more solute than it can normally hold under existing conditions. (b) Solution that is a poor conductor of electricity (c) Solution that contains less than the maximum amount of solute under existing conditions. (d) So'ution that is in a state of equilibrium.

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 10.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
10.13	Cont'd	10.13 .1	Cont'd (e) Solution that is mainly ionic. (f) Solution that is not a conductor of electricity. (g) Amount of solute dissolved in a given amount of solvent at equilibrium under existing conditions. (h) Amount of solute dissolved in a given amount of solvent at S.T.P.
10.14	Given four choices and specified data, the student will select the correct freezing point of a solution.	10.14 .1	A solution consists of 15.0 g. of sucrose, $C_{12}H_{22}O_{11}$, in 150.0 g. of water. What is the freezing point of the water? 1. - .2° C. 2. - 2.0° C. 3. - .5° C. 4. - 5.0° C.

ANSWER KEY
T.P.O. 10.0

10.1.1 3
10.2.1 2
10.3.1 4
10.4.1 3
10.5.1 2
10.6.1 2
10.7.1 1
10.8.1 2
10.9.1 2
10.10.1 3
10.11.1 3
10.12.1 3
10.13.1

(1) g
(2) d
(3) c
(4) b
(5) e
(6) a
(7) f

10.14.1 3

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O. The student will demonstrate his knowledge, understanding, and skills as they relate to chemical reactions (acid-base and simple oxidation-reduction) as evidenced by 90% of the students achieving at least 70% of the possible 100% on the criterion measures that are included in the I.P.O.'s, and teacher evaluation of laboratory experiences.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.1	Given the formula of an ionic compound which is soluble in water, the student will select from four choices the correct formula for one of the ions.	11.1 .1	The correct formula for one of the ions formed when NaCl is dissolved in water is: 1. $Na^-(aq)$ 2. $Cl^- \cdot H_2O$ 3. $Cl^+ \cdot H_2O$ 4. $Na^+(aq)$
11.2	Given two reactants for a chemical reaction, the student will select from four choices the correctly balanced net-ionic equation for the reaction.	11.2 .1	Which of the following is the correctly balanced net-ionic equation for the reaction between zinc and sulfuric acid: 1. $Zn^{++}(aq) + SO_4^{=}(aq) + 2H_3O^+(aq) \longrightarrow 2H_2O + Zn^{++}(aq) + SO_4^{=}(aq) + H_2(g)$ 2. $Zn^{++}(aq) + 2H_3O^+(aq) + SO_4^{=}(aq) \longrightarrow ZnSO_4 \downarrow + 2H_2O + H_2 \uparrow$ 3. $Zn^{\circ}(s) + 2H_3O^+(aq) \longrightarrow H_2 \uparrow (g) + Zn^{++}(aq) + 2H_2O$ 4. $Zn^{\circ}(s) + H_2^+SO_4^{=}(aq) \longrightarrow H_2^+ \uparrow + SO_4^{=} + Zn^{++}(aq)$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.3	Given a precipitation reaction where two ionic solutions are mixed, the student will choose the correctly balanced net-ionic equation from four choices.	11.3 .1	The balanced net-ionic equation for the precipitation of silver chloride from the reaction of sodium chloride and silver nitrate is: 1. $NaCl + AgNO_3 \longrightarrow AgCl\downarrow + NaNO_3$ 2. $Ag^{++} + 2Cl^- \longrightarrow AgCl_2\downarrow$ 3. $Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$ 4. $AgCl(aq) \longrightarrow AgCl(s)$
11.4	From four choices, the student will choose the statement which best completes the definition of a Bronsted-Lowry acid or base.	11.4 .1	According to the Bronsted-Lowry Theory of acids and bases, acids may be defined as a species that: 1. Loses a proton in a chemical reaction. 2. Loses an electron in a chemical reaction. 3. Gains a proton in a chemical reaction. 4. Gains an electron in a chemical reaction.
11.5	Given four choices, the student will select the conjugate acid-base pair in a specified reaction.	11.5 .1	In the reaction $H_3O^+ + SO_4^= \longrightarrow HSO_4^- + H_2O$, the conjugate acid-base pair is: 1. HSO_4^- and $SO_4^=$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.5	Cont'd	11.5 .1	2. H_3O^+ and $SO_4^=$ 3. HSO_4^- and H_2O 4. H_3O^+ and H_2O
11.6	Given four statements about strong acids, the student will choose the statement which is incorrect.	11.6 .1	Of the following statements, all are true about strong acids except: 1. Acids which ionize completely in water solution are strong acids. 2. Solutions of strong acids are mostly ionic. 3. Solutions of strong acids are strong electrolytes. 4. Strong acids furnish few ions in solution.
11.7	Given four choices, the student will select the three acids which are industrial or strong acids.	11.7 .1	The common industrial (strong) acids are: 1. acetic, nitric, sulfuric 2. nitric, sulfuric, hydrochloric 3. phosphoric, ammonium, acetic 4. sulfuric, hydrofluoric, cyanic
11.8	Given four choices, the student will select the correct formulas which represent the water solution of a specified acid.	11.8 .1	The correct formulas which represent a solution of hydrochloric acid are: 1. H^+ and Cl^- 2. H_3O^+ and Cl^-_2 3. H_3O^+ (aq) and Cl^-(aq)

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.8	Cont'd	11.8 .1	Cont'd 4. H_2^+ (aq) and Cl^- (aq)
11.9	Given an acid and a base, the student will identify from four choices the correctly balanced net-ionic equation for the reaction.	11.9 .1	Which of the following is the correctly balanced net-ionic equation for the reaction between NaOH and HCl? 1. $OH^-(aq) + H_3O^+(aq) \longrightarrow 2H_2O$ 2. $NaOH + HCl \longrightarrow NaCl + H_2O$ 3. $Na^+(aq) + OH^-(aq) + H^+(aq) + Cl^-(aq) \longrightarrow Na^+(aq) + Cl^-(aq) + H_2O$ 4. $NaOH + H_3O^+(aq) + Cl^-(aq) \longrightarrow Na^+(aq) + OH^-(aq) + H^+(aq) + Cl^-(aq)$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.10	Given four choices, the student will identify the definition of oxidation.	11.10 .1	Any chemical reaction which involves the loss of one or more electrons by an atom or ion is: 1. reduction 2. hybridization 3. catalysis 4. oxidation
11.11	Given four choices, the student will identify the definition of a reducing agent.	11.11 .1	A substance which acts as a reducing agent: 1. gains electrons 2. loses electrons 3. gains protons 4. loses protons
11.12	Given the reactants involved in an oxidation-reduction reaction, the student will identify from four choices the correctly balanced net-ionic equation for the reaction.	11.12 .1	The correctly balanced net-ionic equation for the reaction between sodium and water is: 1. $2\ Na(s) + 2H_2O \longrightarrow 2\ NaOH(aq) + H_2\ (g)\uparrow$ 2. $2Na^+ + 2\ e^- + 2H_2O \longrightarrow 2Na^\circ + 2H_2O$ 3. $2Na^\circ(s) + 2H_2O \longrightarrow 2Na^+(aq) + 2OH^-(aq) + H_2\ (g)\uparrow$ 4. $2Na^+(aq) + H_3O^+\ (aq) \longrightarrow H_2O + H^+(aq) + 2Na^\circ\ (aq)$

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.13	Given four choices, the student will select the correct equivalent weight of a specified compound.	11.13 .1	The equivalent weight of calcium chloride is: 1. 111 g. 2. 555 g. 3. 37 g. 4. 27.75 g.
11.14	Given four choices, the student will select the statement which best describes titration.	11.14 .1	Titration is a process which: 1. occurs only between acids and bases. 2. reaches an end point at pH 7. 3. measures the capacity of a solution of unknown concentration to combine with one of known concentration. 4. measures the extent of acid-base ionization in aqueous solutions.
11.15	Given four choices, the student will select the volume of an acid or base needed to react with a standard acid or base.	11.15 .1	How many ml. of .1 N NaOH will react with 20 ml. of .12 N HCl? 1. 20 ml. 2. 24 ml. 3. 16.6 ml. 4. 1 ml.
11.16	Using the results from the above question, the student will identify from four choices the pH of the resulting solution at its end point.	11.16 .1	The pH of the above resulting solution at its end point is: 1. 1 2. 14 3. 7 4. 0

COURSE CHEMISTRY

TERMINAL PERFORMANCE OBJECTIVE NO. 11.0

SKILL/KNOWLEDGE BASED ON:

T.P.O.

NO.	INTERMEDIATE PERFORMANCE OBJECTIVES	NO.	CRITERION MEASURES
11.17	Given the normality of an acid, the student will select from four choices the molarity of the given solution.	11.17 .1	The molarity of a solution of 1.0 N sulfuric acid is: 1. 1.0 M 2. 2.0 M 3. 0.50 M 4. 0.25 M
11.18	Given a partial definition containing one of the factors which makes up a conjugate acid, the student will identify the other factor from four choices.	11.18 .1	A conjugate acid is formed when a base: 1. takes on a proton 2. takes on an electron 3. gives up a proton 4. gives up an electron
11.19	The student will identify from four choices the products of a neutralization reaction.	11.19 .1	The products of a neutralization reaction are: 1. an acid and a base 2. water and a salt 3. an acid and a salt 4. a base and water
11.20	The student will identify from four choices the most common base.	11.20 .1	The most common base is the: 1. hydrogen ion 2. hydronium ion 3. hydroxide ion 4. ammonium ion

ANSWER KEY
T.P.O. 11.0

11.1.1	4
11.2.1	3
11.3.1	3
11.4.1	1
11.5.1	1
11.6.1	4
11.7.1	2
11.8.1	3
11.9.1	1
11.10.1	4
11.11.1	2
11.12.1	3
11.13.1	2
11.14.1	3
11.15.1	2
11.16.1	3
11.17.1	3
11.18.1	1
11.19.1	2
11.20.1	3